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β-decay spectroscopy with laser-polarised beams of neutron-rich potassium isotopes at VITO

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β-decay spectroscopy is a powerful tool for studying complex phenomena emerging in exotic neutron-rich nuclei, such as β-delayed neutron emission [1-3]. Thanks to the high angular momentum selectivity of the process, β-decay offers unique access to excited states in daughter nuclei having configurations similar to the decaying precursors.

β-decay spectroscopy becomes an even more powerful technique when beams of spin-oriented nuclei are utilized [4,5]. For such nuclei –having a directional orientation of the nuclear spins with respect to the axis of an applied magnetic field - asymmetric emission of β-particles can reveal spins and parities of nuclear states involved in allowed transitions.
This novel approach to β-decay experiments, pioneered by a group from the University of Osaka [4,5], has recently been adopted at the VITO beamline [6] at ISOLDE, where a new decay-spectroscopy station has been integrated with the existing setup for laser-induced spin polarisation. The new station, called "DeVITO", allows measurements of β-particle emission asymmetry in coincidence with γ-rays and/or neutrons. Moreover, the new station also allows the evaluation of the radiation asymmetry nearly free from instrumental asymmetry. This is achieved by reversing the direction of the nuclear spin orientation and comparing measurements performed for these two configurations.
The new setup was recently commissioned with beams of neutron-rich potassium isotopes, including strong β-delayed neutron emitters. In particular, the beam of 47K, with a well-known decay scheme from previous extensive studies [7], was chosen to investigate β-particle emission asymmetry in coincidence with γ-rays. In this contribution, details on the experimental setup, as well as preliminary results from the commissioning runs [8, 9], will be presented.

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